

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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## (54) FILTERS

(71) We, GENERAL MOTORS LIMITED, a British Company of 23 Buckingham Gate, London, S.W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to filter assemblies for fluids and to methods for the manufacture of such assemblies. The invention is suitable in particular for air filters for internal combustion engines, but could also be used for oil filters for internal combustion engines.

A filter assembly according to this invention comprises a filter element formed from a strip of sheet filter material folded about a series of transverse fold lines to form a series of accordion pleats the ends of each of which are sealed separately from those of adjacent pleats so as to form the pleats into a series of pockets which are arranged in the form of a flat panel at one plane face of which are the open ends of said pockets, the peripheral wall of the panel-form element being enclosed within and sealed to a frame of U-section. The frame may carry a peripheral seal strip of elastomeric material.

The filter element is preferably made from synthetic resin impregnated filter paper or like sheet filter material; plastics or other materials, such as felt may be used for the seal strip.

The frame is conveniently formed from flat strip material such as thin sheet steel, bent to U-section and is preferably made in two parts of L-shape each of which engages a side and end wall of the panel, the two parts of the frame being secured together by folded-over tabs integral with the portions of the frame.

The scope of the invention is defined by the appended claims; and the invention and the method by which it is to be performed are hereinafter particularly described with reference to the accompanying drawings, in which:—

Figure 1 is a part sectional perspective view of part of the pleated filter element;

Figure 2 is an elevation of the panel form filter assembly according to the invention;

Figure 3 is an inverted plan of the filter assembly;

Figure 4 is a plan of the assembly shown in Figures 2 and 3 with a seal strip attached thereto;

Figure 5 is a section of the seal strip only, on the line V—V of Figure 4;

Figure 6 is a section of a modified form of construction of seal gasket;

Figure 7 shows stages in the formation of the frame of the panel form filter assembly;

Figure 8 is an elevation of the inside of the strip formed after the operations shown in Figure 7;

Figure 9 is an outside elevation of the strip shown in Figure 8; and

Figure 10 is a plan of the strip shown in Figure 9.

Figure 1 shows the method of forming a filter element 1 which forms part of the filter assembly shown in Figures 2 and 3. The filter element 1 shown in Figure 1 comprises a sheet of synthetic resin-impregnated filter paper 2 which is folded about a series of transverse fold lines to form a series of accordion pleats 3 the ends 4 of which are sealed separately from those of adjacent pleats by means of adhesive 5 which is applied to the longitudinal edges of the strip before it is folded. In this way the sheet 2 is formed into a series of pockets which are arranged in the form of a flat panel at one plane face of which are the open ends 6 of the pockets. The sheet filter material is preferably embossed with spacer dimples 7 or like formations by which the two parts of the pleats 3 may be spaced from each other and each pleat spaced from adjacent pleats.

The peripheral wall of the panel form element 1 formed in this way is enclosed within and sealed to a frame 11 of U-section to form the filter assembly 10 shown in Figures 2 and 3. The frame 11 is conveniently formed from

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flat strip material, such as thin sheet steel bent to U-section and is conveniently made from two parts of L-shape, each of which engages a side and an end wall of the panel element 1, the two parts of the frame 11 being secured together by folded over tabs 12 and 14 which are integral with the portions of the frame and are respectively at opposite ends of each L-shaped portion thereof.

In a preferred method of forming a frame 11 for the element 1 a strip of thin sheet metal 20, which may be unrolled from a coil of the strip, is passed under a succession of tools (not shown), one of which forms a pair of V-shaped notches 21 at opposite sides of the strip so as, when the strip is folded about the notched portion, to form a mitred corner in one part of the frame 11, the strip then passing under another tool which forms at opposite sides of the strip 20 two further shaped notches 22 which, in a subsequent cropping operation, will constitute a mitred end of the frame part and also form the tabs 12 and 14 which are integral with the mitred end.

The strip 20 thus notched is then passed through rollers which bend up opposite edge portions 23, 24 of the strip 20 so that it is given a U-shaped channel cross-section, the strip 20 finally passing under a cropping tool (not shown) which cuts through the strip and the shaped notch portion 22 thereof to form at one side of the cut two tabs 14 separated by a central space and, at the other side of the cut, a central tab 12 with spaces to each side thereof.

The cropped and formed strip 20 then passes under a nozzle 25 through which adhesive 26 is delivered on to the base of the U-shaped channel form strip 20 so as to coat the latter with a layer of the adhesive 26 throughout the length and width of the channel form strip.

Two such formed strips are folded at the V-shaped notched portions 21 thereof to form them into the two L-shaped parts of the frame 11 shown in Figure 3, the frame parts then being each applied to respective sides and ends of the rectangular panel form element 1 formed from the pleated folded filter paper 2, the adhesive 26 applied to the base of the channel of the frame parts forming a seal with the respective sides and ends of the panel element 1. The tabs 12, 14 at each end of each part of the L-shaped frame 11 are then bent over at right angles so as to engage the adjacent ends of the other frame part, and secure the two frame parts to each other.

In an alternative arrangement the frame may be made as a single part, in which case the strip 20 is formed with two further pairs of the V-shaped notches 21, at opposite sides of the strip 20, which are spaced relative to the shaped notches 22 so as to form the mitred

corners in the finished plane after the strip has been folded at the V-shaped notches 21 and the two ends secured together by the tabs 12, 14 thereon.

The panel form filter assembly thus formed can be mounted on a rectangular mount face in a filter housing, the housing being provided with a seal gasket to engage the frame and form a seal therewith; alternatively the frame may have a U-section seal gasket 30 (Figures 4 and 5) of elastomeric material secured thereto, in which case the gasket 30 may be attached to the frame by adhesive or made as a continuous rectangular strip of the elastomeric material of U-section, which is fitted over the frame 11 and secured thereto by stretch fit or with adhesive.

In an alternative construction, shown in Figure 6, a seal gasket 32 may be of L-section and be secured by stretch fit or with adhesive to the frame 11, the gasket in this case having only a single seal surface 33 thereon.

The above described method of forming the frame for the panel element enables panel filter elements of different sizes to be produced simply and inexpensively, as the spacing between the notching and cropping tools determines the lengths of the two portions of the L-shaped frame part, that is, the length and width of the completed panel element. Assuming that the depth of the pleats of the element remains the same, the only change required to form elements of different dimensions is the spacing between the tools which carry out the notching and cutting operations.

#### WHAT WE CLAIM IS:—

1. A filter assembly comprising a filter element formed from a strip of sheet filter material folded about a series of transverse fold lines to form a series of accordion pleats the ends of each of which are sealed separately from those of adjacent pleats so as to form the pleats into a series of pockets which are arranged in the form of a flat panel at one plane face of which are the open ends of said pockets, the peripheral wall of the panel-form element being enclosed within and sealed to a frame of U-section.

2. An assembly according to claim 1, in which the filter element is made of synthetic resin impregnated filter paper.

3. An assembly according to claim 1 or 2, in which the frame carries a peripheral seal strip of elastomeric material.

4. An assembly according to any of claims 1 to 3, in which the frame is formed from flat strip material bent to U-section, the end of the frame being secured together by folded-over tabs integral therewith.

5. A filter assembly substantially as hereinbefore particularly described with reference to the accompanying drawings.

6. A method of making a filter assembly,

substantially as hereinbefore particularly described with reference to the accompanying drawings.

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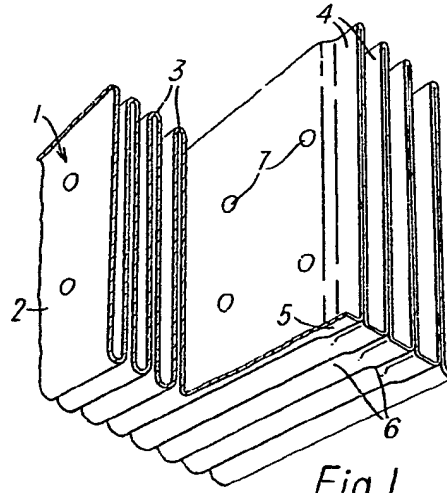
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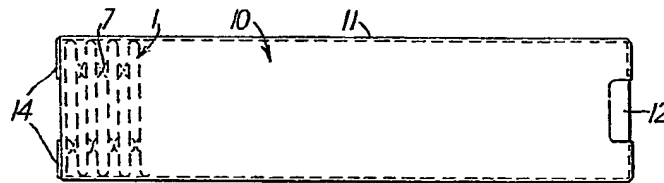
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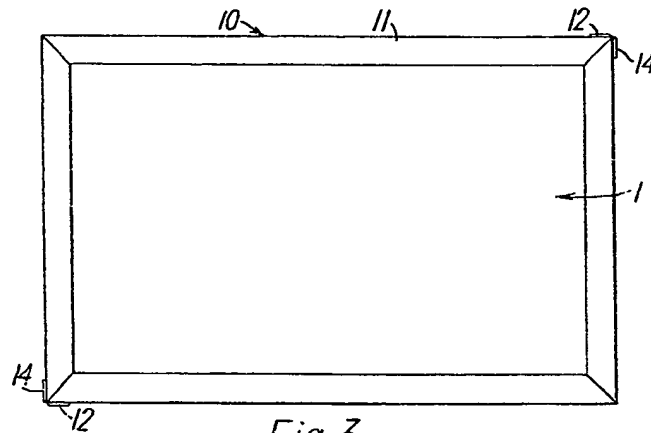
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Sheet 1



*Fig. 1.*

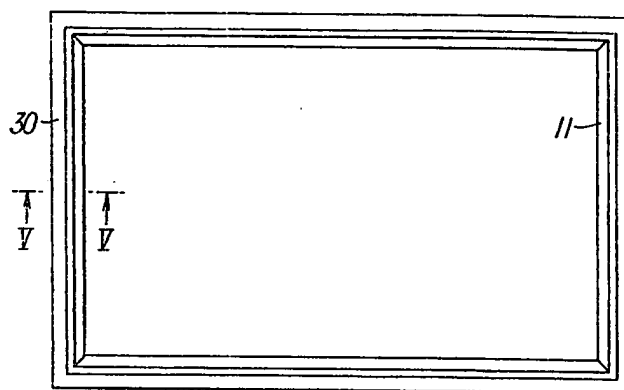


*Fig. 2.*

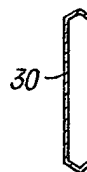


*Fig. 3.*

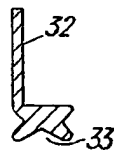
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*Fig. 4.*



*Fig. 5.*



*Fig. 6.*

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